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# canada in the aerospace age

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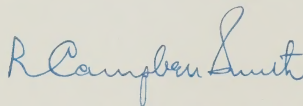
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# CANADA AT THE 26TH INTERNATIONAL AIR AND SPACE SHOW

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Halls B2 and C, Le Bourget Airport, Paris, France, June 10 to 21, 1965

Once again we take pleasure in welcoming you to the Canadian Exhibit at the International Air and Space Show at Le Bourget Airport, Paris, June 10-21, 1965. This booklet lists the Canadian exhibitors and describes the outstanding products they have to offer. Representatives of the exhibiting companies and the Canadian Department of Trade and Commerce will be pleased to answer inquiries at the Show. Information on the full range of quality products and services available from Canada can be obtained at any time from this office or any of the other Canadian trade offices listed elsewhere in this booklet.



R. Campbell Smith  
Minister-Counsellor  
(Economic/Commercial)  
Canadian Embassy  
35, avenue Montaigne  
Paris 8e  
Tel: BALzac 99-55



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## canadian aerospace achievements

Canada's aerospace industry is rapidly expanding its capability and developing product lines comparable to those of its international competitors. Many of these products are unique with domestic and export markets assured.

Rugged, light, utility, amphibious aircraft such as the Beaver and Otter are in production and complementing these is the heavier and versatile Caribou. This family of aircraft now being turbinized, will soon be available in domestic and world-wide markets.

The development of a 12,500-pound V/STOL tilt-wing aircraft is another example of Canadian design and production skill. The first prototype of this machine will fly in September of 1965. Exploratory work is in progress for the design and development of an aircraft for forest fire-fighting operations; this aircraft will be of flying-boat configuration and its versatility will extend to conversion for short haul passenger and cargo services.

Canada is developing and, in late 1965, will flight-test a tandem two-place gyroplane powered by a 200 hp. engine. This machine has a 32-foot diameter three-bladed auto-gyrating rotor providing lift in flight. It is a versatile, low-cost machine capable of jump starts and ideally suited to operate from unprepared ground. The gyroplane has a normal loaded weight of 19,000 pounds and a range of more than 400 miles. Potential military and commercial users are watching the progress of this machine with intense interest.

Canada continues to demonstrate its aircraft skills in the tooling and production of a wide range of aircraft types. The flexibility of Canadian industry is well demonstrated by DC-9 manufacturing work being undertaken which includes main planes, empennage and aft-fuselage construction. Continuing manufacturing programs of this type reinforce the aerospace industry and will assist Canada to participate in similar future joint international projects.

Accuracy and ruggedness are mainly responsible for the world-wide popularity of the Canadian Doppler system. This airborne navigational system gives true ground-mark navigation readings and can be fitted to both fixed and rotary winged machines.

Another prominent Canadian electronic device is the Position and Homing Indicator (PHI). This equipment, originally designed in the RCAF, is now being fully developed and is standard to many NATO aircraft. Other technical achievements in the electronics field include a powerful, compact tactical UHF transceiver weighing less than 10 pounds which can operate on any one of 3,500 channels, and the Crash Position Indicator (CPI). This latter device is stored in an aero-foil shaped container and may be released prior to emergency landings to transmit short-wave signals which can be picked up on standard receivers. The CPI is invaluable for aircraft operations in remote regions.

The hazards of landing and securing helicopters on ocean-going vessels are well understood by naval and merchant fleets. The Canadian "Bearcat" winch, a device recently developed, will effectively assist the helicopter pilot to land and secure the machine to the deck in gale conditions.

In the propulsion field, the Canadian PT6, 575 hp. gas turbine is a front runner in its class. This light-weight, low-cost aeronautical gas turbine is installed in a wide variety of fixed and rotary wing aircraft, sea-going and amphibious vessels. It also has many industrial applications.

Canada was the third nation to have a satellite in orbit when the Alouette I was launched with the aid of a Thor-Agena rocket. A network of tracking stations is still receiving a steady stream of information and the vehicle will soon be supplemented by the Alouette II. The study of the ionosphere is to be continued in subsequent years by Canadian-built ISIS satellites.

Impetus was also given to Canada's participation in satellite communications when the Government authorized the construction of a \$5-million ground station. Located on Canada's eastern seaboard, this station will accommodate facilities for radio, television, teletype, facsimile and data processing. Communications will be transmitted and received either by intermediate-altitude random-orbit satellites such as Relay and Telstar or by synchronous satellites similar to Syncom.

Canadian Black Brant rockets are available in two sizes. The smaller size lifts a 40-pound payload to an altitude of 110 miles and the larger a 150-pound payload to 240 miles. In support of their operations are a solid fuel manufacturing plant and an industry capable of instrumenting them for any type of upper atmospheric experiments with a unique capability for auroral investigations.

Advanced aerophysical techniques are enabling old naval guns to be put to a new

use. In the island of Barbados, Canadian scientists and technicians are using a 16-inch naval gun to fire projectiles to altitudes of more than 100 miles. As a result of these experiments, instrumented payloads may now reach high altitudes with significant economy.

Many of these Canadian achievements will be displayed at the 26th International Air and Space Show in Paris. The proficiency of these and other Canadian companies forming Canada's aerospace industry has been well established. Inquiries will be welcomed by officials of Canada's Department of Trade and Commerce and by company representatives at the Canadian exhibit.

## AVIONICS LIMITED / P.O. Box 200, Stone Road, Niagara-on-the-Lake, Ontario, Canada

Avionics Limited has manufactured printed circuits for the electronics industry since 1953. From a relatively simple product, originally made from a copper foil laminated to a paper-base phenolic resin, the company now manufactures a wide variety of printed circuits, terminal and component boards, name plates and dials as well as thermal electric cooling devices.

Avionics printed circuits are also made in several types of glass fabric epoxy resin materials including general-purpose, temperature-resistant and flame-retardant grades.

The company's glass fabric base materials are impregnated with silicone, melamine or Teflon resins, and flexible printed circuits are supplied on Mylar or Teflon base materials. Flush circuits for switching applications are also produced.

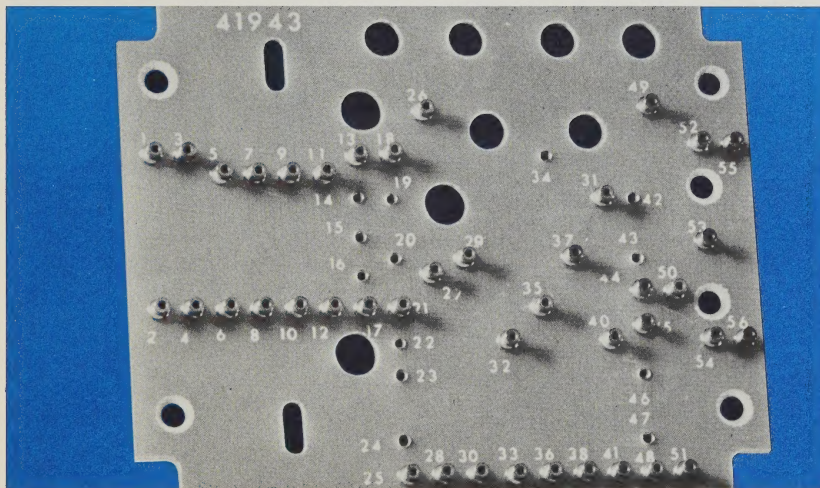
Circuit finishes are available in copper, silver, gold, solder and tin. Plug-in contacts can be provided by electro-plating — usually gold over nickel or rhodium over nickel — or by mechanical connectors attached to the printed circuit.

Another product is the Coolatron — thermal

electric module — a junction composed of a chemical combination of bismuth and tellurium. Coolatrons are noiseless, reliable, require minimum maintenance and are used in cooling laboratory equipment, household or portable refrigeration, medical and aerospace applications, temperature control of electronic and other scientific equipment.

Avionics Limited is always experimenting with new materials, finishes and processes to improve the quality of its products and offers such services as precious metal electro-plating, machining, blanking, silk screening and etching.





printed circuits

A terminal board, one of the many products manufactured by Avionics Limited. The board material is a fibreglass epoxy laminate with brass, gold-plated terminals.

## CENTRAL DYNAMICS LTD. / 147 Hymus Boulevard, Pointe Claire, Quebec, Canada

Since its establishment in 1958, Central Dynamics Ltd. has expanded rapidly. Stimulated by select engineering graduates from the world's finest universities, a determined "pride of workmanship" spirit sparks every phase of the company's operation.

Central Dynamics designs and fabricates electromechanical control accessories for aircraft and produces, under licence, special equipment for some of the foremost builders of military aircraft in the United States and Canada.

In the communications field, Central Dynamics Ltd. manufactures a complete range of television terminal equipment for some of the major television network systems in the world, and for numerous independent broadcasting stations and more recently for educational TV institutions.

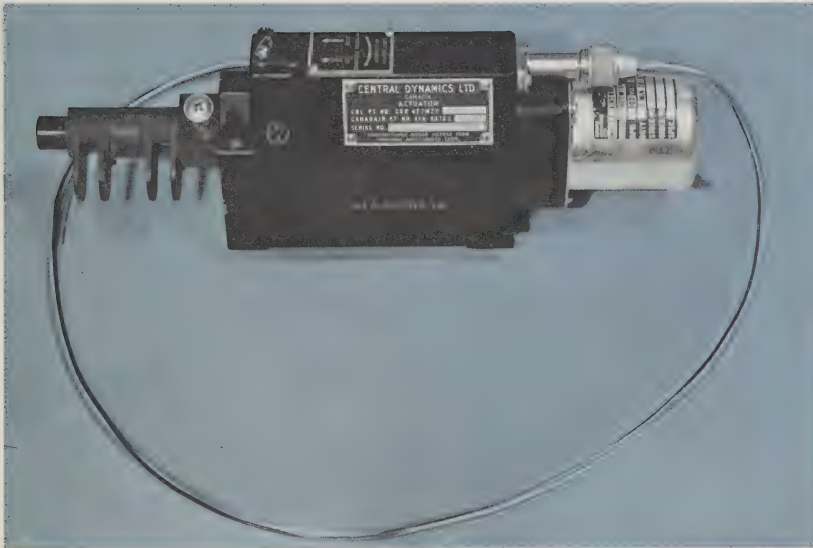
In the field of automation, Central Dynamics Ltd. has supplied highly advanced solid-state systems comprising supervisory control, data acquisition and temperature monitoring systems. These systems have been supplied primarily to the utilities such as provincial government hydro electric facilities, aluminium processing facilities, petrochemical plants, nylon manufacturers and pulp and paper industries.

As a foremost supplier of aircraft accessories, Central Dynamics will exhibit its Model C101044 landing gear control switch. This accessory is adaptable to most aircraft employing retractable undercarriage. A safety feature ensures that the undercarriage cannot be inadvertently raised when the aircraft is on the ground. A rotary solenoid automatically releases the lock when the aircraft is airborne, and as an added feature the locking device can also be manually disengaged.

Other Central Dynamics Ltd. aircraft accessories on display include advanced designs of electromechanical actuators, aero engine heat exchanger, jet engine and aircraft valves and electronic control devices — all used in the latest type of aircraft.

### Represented by:

AEP International Limited  
Grove House  
London Road  
Islesworth  
Middlesex, England



## electromechanical control accessories

The electromechanical actuator is one of the various aircraft accessories displayed by Central Dynamics Ltd. Other equipment includes a landing gear control switch, an aero engine heat exchanger, jet engine and aircraft valves and electronic control devices.

## GARRETT MANUFACTURING LIMITED / 19 Attwell Drive, Rexdale, Ontario, Canada

Garrett Manufacturing Limited is displaying its latest solid-state temperature control systems, static inverters, automatic emergency beacons, and its new flight instrument test sets (pneumatic signal generators).

The windshield and wing anti-icing temperature control systems include lightweight, solid-state controls and rugged, reliable thermistor type sensors. These controls are used for windshield anti-icing on the Canadair CL-44, and wing anti-icing on the Sud Caravelle 10B3 and the Canadair CL-44. Later type windshield systems incorporate power modulation capability to avoid thermal shock. Aircraft cabin and crew compartment temperature control systems displayed, feature fully solid-state controls and thermistor type sensors. The company's engineers have designed these systems to cater for the extremes in temperature and altitude encountered by such aircraft as the General Dynamics F-111, Douglas DC-9, Boeing 727, Lockheed C-141, de Havilland Buffalo, Sud Caravelle 10B3, McDonnell (Phantom) F-4, and the Lockheed F-104.

Garrett is also showing its new 750 va single phase static inverter. This unit is now in quantity production for the Canadair CL-41 and is the only 750 va, single phase unit of this type which

has reached this stage of production and qualification in North America. It converts 18.5/29 volts dc to 115-volts, 400-cycle ac power and incorporates silicon controlled rectifiers for power switching. It incorporates self-protection and complete radio interference suppression to the dc input system and complete output transient suppression to the ac system. The unit has capability for interrupting individual circuit breakers in the aircraft power system being fed by this inverter.

Garrett has a complete line of single phase, static inverters from 30 va to 1,000 va for use in supplying 400-cycle power. These inverters provide trouble-free operation far in excess of 3,000 hours and are much more efficient than the old rotary type inverters.

The automatic emergency beacon is a compact, fully automatic VHF radio beacon which reduces the time lag between an emergency and rescue. The new 4¾-pound RESCU/1 is a small, self-activating device which transmits automatically by water-activated batteries for more than 42 hours on 121.5 mc and/or 243 mc. The signal can be monitored by the majority of military and commercial air-sea-rescue units. These beacons are approved by the U.S. Federal

Aviation Authority and are now in use by such airlines as Eastern, National, Avianca and World Airways. They are scheduled to be used in the New Douglas DC-9 and Boeing 727.

Garrett Manufacturing has developed a complete line of pneumatic signal generators for precision checkout of air data computer systems, flight instruments, automatic flight control systems, pressure ratio systems and transducers. They can simulate altitude from — 1,000 ft. to + 80,000 ft. and simulate air speeds from 50 to 900 knots. The company has a wide range of configurations and options — models come with either direct digital readout or aircraft instrument readout. Modulated pneumatic outputs for use with digital checkout equipment are also available. Total temperature simulation is provided as required. Seven national air forces use Garrett PSGs, and the latest unit has been supplied to the U.S. Air Force as a standard test set for the F4C, C-141 and F-101.



**Represented by:**

Garrett International S.A.  
The Garrett Corporation  
Rue des Pierres-du-Niton 17  
Geneva, Switzerland

Garrett AiResearch Limited  
302-308 High Street  
Slough, Bucks., England

Garrett International S.A.  
36, rue des Plantes  
Paris 14e, France

Garrett International S.A.  
3, rue de l'Orient  
Toulouse (H-G), France

Garrett GMBH/Interaero GMBH  
Bethmannstrasse 50-54  
6 Frankfurt am Main, Germany



temperature controls,  
static inverters,  
beacons,  
pneumatic signal generators

Garrett Manufacturing has developed a complete line of pneumatic signal generators for precision checkout of air data computer systems, flight instruments, automatic flight control systems, pressure ratio systems and transducers.

## IRVIN AIR CHUTE, LIMITED / 479 Central Avenue, Fort Erie, Ontario, Canada

Safety equipment manufactured by Irvin Air Chute, Limited includes personnel parachutes, aircraft deceleration chutes, pressure clothing, inflatable safety products, restraint devices, automatic parachute opening devices for high-speed escape and special models for sky diving.

For its CF-104 and CF-101 aircrew personnel, the Royal Canadian Air Force uses the Irvin type B-5 personnel parachute. This chute is 28 feet in diameter and is equipped with an Irvin Mark 10A opener. The CF-104 is also equipped with an Irvin deceleration chute to help brake the aircraft when landing. The Tutor and T-33, both jet aircraft of the RCAF, use the Irvin-designed back pack parachutes.

The Irvin automatic barometric release, fitted to parachute assemblies of aircrew personnel flying high-altitude, high-speed aircraft, ensures automatic operation of the parachute after separation from the ejection seat.

Pressure clothing manufactured by Irvin Air Chute, Limited includes anti-gravity suits — full suits and half suits — and a pressure breathing waistcoat. The latter is a supporting garment for the chest which also provides

an external pressure to the anterior chest to assist the action of breathing. Should cabin pressure fail, the waistcoat allows the wearer several minutes to take corrective action.

Other items of inflatable equipment manufactured by the company include marker buoys, a helicopter pilot's survival garment and an integrated restraint garment — a flight suit which provides restraint and containment in the aircraft, parachute deployment shock distribution, anti-G protection and flotation for water landing.

Irvin Air Chute, Limited also manufactures aircraft survival kits and a variety of safety belts.





## aircraft safety equipment

The Irvin deceleration parachute blossoms, slowing this RCAF CF-104 to a safe, unswerving stop. Drag chutes are used regularly on high-performance aircraft to ease the load on tires and brakes and shorten landing roll.

## COLLINS RADIO COMPANY OF CANADA LIMITED / 150 Bartley Drive, Toronto 16, Ontario, Canada

Since its establishment in 1953, Collins Radio Company of Canada Limited has been engaged in the design and manufacture of high quality communications equipment. Among the company's achievements have been tropospheric scatter lateral communications systems for Canada's Distant Early Warning Line, HF and UHF communications systems for the Royal Canadian Navy and Royal Canadian Air Force and UHF communications systems for F104 Starfighter aircraft used by the Japanese, NATO countries and also supplied under the United States Mutual Aid program.

Collins Radio is currently developing one of the most compact multi-channel radio sets ever designed for military use. This is a UHF transmitter/receiver capable of portable or hand-held operation on any one of 3,500 channels. This AN/PRC-66 transceiver being designed for the U.S. Air Force — with a modified version AN/PRC-69 for the U.S. Marine Corps — measures 2" x 4" x 6" and weighs less than 10 pounds including battery, antenna, and accessories.

Integrated circuit and thin film techniques are used to the fullest extent possible in both digital and linear circuits to achieve maximum equipment reliability and to greatly reduce size, weight and power consumption. The basic

building block of the AN/PRC-66 is a solid-state microelectronic packet and functionally related packets are grouped to form modules. Simple mechanical design coupled with microelectronic circuitry will substantially ease maintenance and logistic support requirements.

The transceiver operates under all environmental conditions to which pack set equipments are subjected.

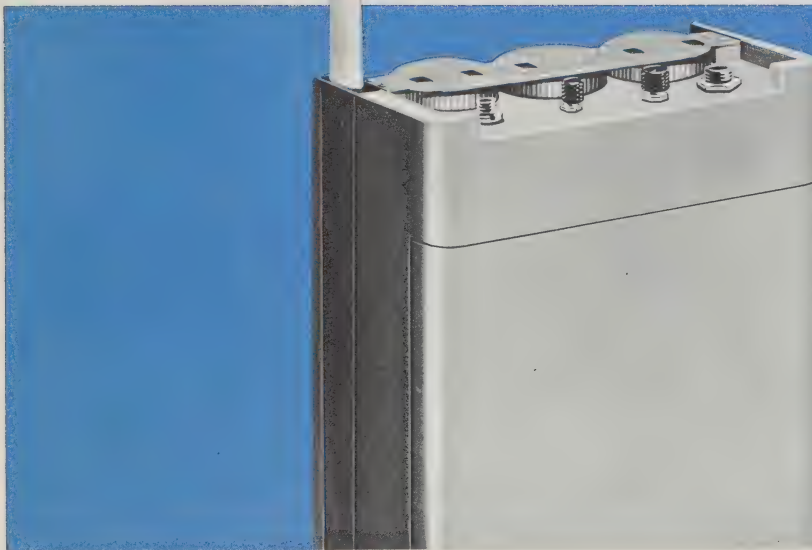
Other products exhibited include a 20-watt power amplifier that can be directly connected to the PRC-66 transceiver. This amplifier is added where higher power is required and uses only primary power and rf input and output connections.

The 718B-7 and 718B-8 UHF auxiliary transceivers which are in production are also on display. These crystal controlled miniaturized units supplement primary airborne UHF transceivers, or can provide UHF capability in aircraft fitted with HF or VHF equipments. They provide five-channel UHF/AM communication within any 2 mc range from 225-300 mc. The transmitters have a nominal power output of 3 watts and the receiver sensitivity is 4 microvolts for a 10 db S+N/N ratio. Aircraft 28 v dc power may be used, or a sealed nickel-cadmium battery will supply power for the equipment.

### Represented by:

T. A. Campobasso  
Collins Radio International C.A.  
Cranford  
Hounslow, Middlesex, England





## UHF communications equipment

The AN/PRC-66 transceiver is the most compact multi-channel UHF radio set ever designed for military use. This ultra-high frequency transmitter/receiver operates on any one of 3,500 channels. The five control knobs on top of the radio set provide frequency selection, volume control and on-off operation.

## UNITED AIRCRAFT OF CANADA LIMITED / P.O. Box 10, Longueuil, Quebec, Canada

United Aircraft of Canada Limited was incorporated in 1928 under the name of Canadian Pratt & Whitney Aircraft Company, Limited, as an aero engine supply and overhaul base. Over the intervening years this internationally known company has expanded substantially, extending its operations into many new areas — propellers, aircraft accessories, electronic components, the helicopter field and, more recently, research and development of small gas turbine engines.

United Aircraft of Canada's PT6 gas turbines were initially delivered in December 1963 following certification. Nine manufacturers in four countries have ordered these durable, quiet engines to power 18 different types of aircraft. Among the aircraft using the PT6 are the Beech King Air, Potez P841, Pilatus Turbo-Porter, Helio Stallion, the de Havilland Turbo-Beaver and Twin Otter, the American Turbine Engine Company Beech 18 and the Lockheed Aerogyro.

The PT6 has been designated as the T74 by the U.S. Military and is currently engaged in four military operations.

The PT6 is a lightweight free turbine engine

designed for fixed and rotary wing aircraft. It has a moderate pressure ratio and the arrangement of components and main shafts allows a shorter engine and simplified mechanical details and maintenance procedures.

Maximum rotational speeds are 37,500 rpm for the gas generator rotor, and 33,000 rpm for the power turbine. The maximum output speeds are 6,230 rpm for the turboshaft engine and 2,200 rpm for the turboprop engine.

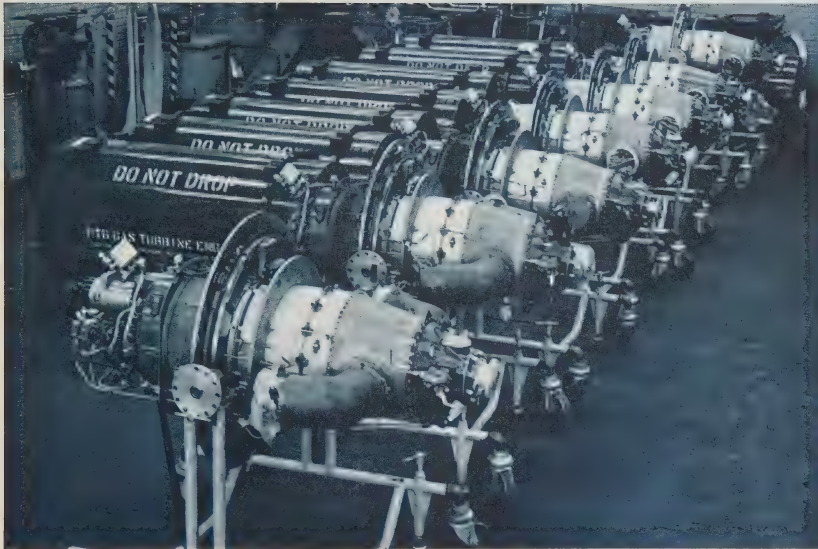
First run of the PT6 was carried out in February 1960. Use of a number of experimental engines permitted a rapid accumulation of running hours coupled with eight full-scale rigs for component testing. Approximately 38,000 hours of engine operation have been logged including more than 12,000 hours of flight time. Engine and component testing now exceeds 57,000 hours.

### Represented by:

United Aircraft International Sarl.  
48, rue de Bassano  
Paris 8e, France

United Aircraft International  
3/5 Warwick House Street  
London, S.W. 1, England

United Aircraft International  
Hohenzollernring 21-23  
Cologne 22c, Germany



gas turbine engines

United Aircraft of Canada Limited's PT6 lightweight gas turbine solves the weight problem for small aircraft. It provides high horsepower from a small engine and is suitable for conventional and vertical take-off aircraft and helicopters. It also has marine and industrial applications.

## TIMMINS AVIATION LIMITED / Montreal International Airport, Dorval, Quebec, Canada

Timmins Aviation Limited specializes in aircraft overhaul and repair, custom design of aircraft interiors, and the manufacture of aircraft galleys.

For British Aircraft Corporation's new short-haul jet airliner, the BAC One-Eleven, Timmins Aircraft Galley and Equipment Division manufactured and fitted two specially designed galleys. The equipment on display — completely new in styling and function — includes ovens, refrigerators, tray carriers, hot cups, hot water heaters and liquid containers.

Two other products exhibited are a collapsible food-serving cart and thermoelectric refrigerator that reduces power requirements by 30 per cent, is practically maintenance-free and can be manufactured to fit any area.

The company converted the Viscount for the use of private corporations — in conjunction with Air Canada — and also converted the well-known PB5Y-5A amphibian to the Super Catalina design by replacing the Pratt & Whitney R-1830 engines with Wright R-2600 engines. Other modifications included an increase in horsepower from 125 to 195, metallization of wing trailing edges, a high vertical fin, new instrumentation, a 4,000-pound increase in

gross weight and a greater payload capacity.

Timmins Aviation operates on an international basis in all facets of its business. The company has the experience and facilities to deliver and service its products anywhere in the world.

### Represented by:

Mr. A. G. Page  
Warspite Trading  
London, England  
de Meiss Limited  
22 Bahnhofstrasse  
Zurich, Switzerland  
Ernst K. Ruckauf & Company  
Stock 1, Eisenplatz 3  
Vienna, Austria

Avicraft AB  
Karlsbodavagen 9  
Bromma, Sweden

Dr. Alfredo Latour  
Intertecno  
181 Via del Babuino  
Rome, Italy





aircraft conversion and furnishings

This is Timmins' newest galley for the BAC One-Eleven — a short-range jet airliner. Equipment includes warming ovens, thermoelectric refrigerator, hot water units, warmer pads, tray carriers, waste container, sink, hot cups, cold water fountain.

## CANADIAN WESTINGHOUSE COMPANY LIMITED / P.O. Box 510, Hamilton, Ontario, Canada

The Totem, a new concept in ground surveillance, is displayed by Canadian Westinghouse Company Limited.

The Totem, a high-grade television camera, is mounted on a stabilized platform and may be raised to a maximum height of 40 feet by an extensible mast. The camera's pictures are viewed on a monitor screen at the bottom of the mast or some distance from it — depending on the length of cable used.

Application of this system includes enemy ground observation, control of artillery and missile fire and early warning of low-flying, slow-speed aircraft.

Also on display is WORTAC, Canadian Westinghouse over-all radar tester and calibrator, which is used in the F-104 Starfighter aircraft. It may be used as a precision boresight calibrator for harmonization or clearance plane checks, and permits fire-control harmonization and alignment, using the true electrical axis in place of the mechanical boresight axis.

Another feature of the company's exhibit is the air transportable satellite communications ground terminal. Designed to be carried in one

cargo aircraft, this terminal enables world-wide communications to be maintained via satellite relays. This equipment offers an unusually complete and reliable communications facility.





ground surveillance,  
radar and  
satellite communications equipment

Exact measurement of aircraft radar rf power, frequency and receiver sensitivity is provided by the Canadian Westinghouse over-all radar tester and calibrator (WORTAC). It also simulates operational targets for performance testing of fire control, bombing, and navigational modes of electronic fire control systems in aircraft.

## ELECTROVERT MANUFACTURING CO. LIMITED / 3285 Cavendish Boulevard, Montreal 28, Quebec, Canada

Electrovert Manufacturing Co. Limited, one of the world's leading producers of wavesoldering systems and equipment, introduced the first wavesoldering unit to North America.

A revolutionary step forward in printed circuit processing, it made high speed, continuous flow, straight line production possible and reduced the contact time between solder and board surface to a minimum.

The Electrovert Model USWA ultrasonic wave applicator with dryer is a breakthrough in ultrasonic cleaning operations. Using the same wave principle as other Electrovert units, the machine produces a 12-inch square, ½-inch high standing wave, formed over a rectangular chamber containing the ultrasonic transducers. This continuously flowing ultrasonically energized wave retains the cavitation effect of the ultrasonic vibration and also has a washing effect. These two effects, combined with the chemical action of the cleaning solvent, develop a sufficiently strong cleaning action to remove all flux residue from the printed circuit board — eliminating damage to components sensitive to ultrasonic waves and vibration.

Also on display is the ACTA — automatic centrifugal tinning apparatus — a recent development designed on the basis of recommendations from NASA experts. It is the only equipment of its kind which performs to NASA requirements. ACTA dips the printed circuit board into an oil-film-covered molten solder bath, spins the board in the solder for an intensive washing effect, slings off the excess solder and shakes clear the component holes and eyelets. All parameters are electro-pneumatically controlled and individually adjustable for optimum results.

The company's WAS wavesoldering system is made up of a wavesoldering unit, fluxwave applicator, heatbank, conveyor mechanism, board carriers, wave cleaner and solvent recovery still. The unit optimizes the use of oil in the soldering process by maintaining high operational stability, control and accuracy. An integral part of this operation is the Positrol forced oil injection adapter which allows the application of oil to the upper surface of the solder wave to be finely controlled and varied in thickness, according to wave height and board conditions. An important factor is that no oil is recirculated at any time.

### Represented by:

SFERE  
(Société française d'Etudes, de Réalisations et d'Equipements)  
106, rue Lafayette  
Paris 10e, France





wavesoldering systems

The automatic centrifugal tinning apparatus (ACTA) in operation. After a two-second dwell cycle the board holder disc is raised above the oil and spun at high speed. Excess solder is removed and holes cleared. Here the front door opens and the carrier is moved horizontally out to the operator for removal.

## LEIGH INSTRUMENTS LIMITED / Box 820, Carleton Place, Ontario, Canada

Leigh Instruments Limited is a young company, organized in 1961 for the design and manufacture of precision components and instruments for aircraft. Its main products include miniature precision gear boxes, magnetic clutches and high-performance transistorized servo amplifiers for military applications.

The company also designs and produces airborne compass repeater systems, crash location beacons and ejectable flight data recorders.

The Leigh airfoil delivery system, based on an entirely new concept in aerial delivery, drops supplies or other critical payloads accurately and safely from planes flying at high or low levels and at all speeds, including supersonic. The Tumbling Airfoil is specially shaped of plastic foam for protection against landing shocks.

The company's flight data recorder system provides a reliable means of recording aircraft flight data, deploys this data safely upon impact and automatically transmits a CW distress signal from the accident location. This lightweight, small-sized system consists of four units: the recorder control unit, the recorder electronics unit, the mounting and release

unit and the recorder beacon airfoil unit.

Leigh Instruments also manufactures the servo repeater amplifier that supplies accurate and compact servo retransmission from a low-power synchro source to a number of isolated high-power torque receivers or control transformers. This amplifier is also used for multiple bearing and heading displays for navigation systems and other repeater applications.

The crash position indicator operates automatically in the event of an aircraft crash. This indicator is a distress radio beacon that is released and deployed on impact. Able to withstand crashes, even of high-performance aircraft, it is economical to install and service.

The servoed altitude indicator shows altitude by two distinct methods: a five-figure, four-drum digital read-out and an outer-dial, single-pointer display. A remotely-set command altitude marker simplifies the task of maintaining a pre-selected altitude. As an additional aid to the pilot, directional arrows appear when the rate of ascent or descent exceeds 3,000 feet per minute.

### Represented by:

Mr. Erik Aronson  
System Paulin Aktiebolag  
Box 49023  
Stockholm 49, Sweden

Dr. M. H. Muller  
Omni Ray AG  
Dufourstrasse 56  
Zurich 8, Switzerland

Mr. H. Klumpp  
Von Engel Avia  
Pempelforterstrasse 8  
Dusseldorf 4, Germany



## aircraft data recording systems

The ejectable recorder beacon airfoil — containing locator beacon and flight data recorder tape cassette — is being installed in the tail of a Yukon aircraft. It is one of four units that make up the flight data recorder system from Leigh Instruments Limited.

## CANADIAN MARCONI COMPANY / 2442 Trenton Avenue, Montreal 16, Quebec, Canada

Canadian Marconi Company's CMA-650 series of Doppler radar sensors is a significant advance in airborne navigational equipment for commercial and military applications. Using four basic major units, optional items can be added to provide accurate navigation information ranging from hover velocities to supersonic speeds at altitudes from two to 55,000 feet.

The basic CMA-650, consisting of an antenna, tracker and transmitter/receiver, provides groundspeed and drift angle data. The units in this series are transistorized and employ plug-in printed circuit boards for maximum design flexibility to meet individual customer requirements.

The CMA-681 navigation computer is fully transistorized, permitting navigation to two or more alternate destinations. The equipment employs digital techniques and is designed for use in fixed and rotary winged aircraft, with inputs provided by Doppler sensors similar to the CMA-650, AN/APN-168, AN/APN-147, AN/APN-501 or AN/APN-503(V). By adding a converter unit this equipment can be made compatible with Doppler sensors which provide voltage analog outputs of groundspeed. The computer is also capable of automatic "Doppler

memory" and "air data" modes of operation.

Nine major airlines and 21 military air services use Canadian Marconi equipment.

Canadian Marconi aviation products are exported to France, Argentina, Austria, Brazil, Chile, Germany, Ireland, Italy, The Netherlands, Norway, Pakistan, Portugal, the Republic of South Africa and the United States.

The company also provides a complete communications service and supplies advanced types of transmitting tubes and other components.

### Represented by:

Franco Britannic Aviation  
15, rue Arsène Houssaye  
Paris 8e, France



airborne navigational devices

The CMA-681 navigation computer is fully transistorized, permitting navigation to two or more alternate destinations. The equipment employs digital techniques and is designed for use in fixed and rotary winged aircraft, with inputs provided by Doppler sensors similar to the CMA-650, AN/APN-168, AN/APN-147, AN/APN-501 or AN/APN-503(V).



## THE DE HAVILLAND AIRCRAFT OF CANADA, LIMITED / Downsview, Ontario, Canada

The de Havilland Aircraft of Canada, Limited is internationally famous for its development of three outstanding STOL — short take-off and landing — utility aircraft. These are the DHC-2 Beaver, the DHC-3 Otter and the DHC-4 Caribou. More recent designs in the STOL concept are the DHC-2, MK 3 Turbo-Beaver, the DHC-6 Twin Otter and the DHC-5 Buffalo. The company's aircraft are now used in 65 countries.

The Turbo-Beaver has the same full range of landing gear alternatives as the Beaver from which it was developed. It is available as a landplane — with wheels or skis — seaplane or amphibian. The cabin is 30 inches (76 cm) longer than the original Beaver's and will accommodate nine people. The Turbo-Beaver is easier to load because of the double front door on the starboard side; both doors are instantly removable. It operates in all climates, for duties as varied as crop spraying in the tropics and air transport in the Arctic.

The Twin Otter meets the long-term requirement for a small, short-haul transport aircraft of mechanical simplicity, short-field capability and engine-out safety. Its turbine power reduces maintenance, has longer overhaul life and is vibration-free in operation. The fuselage is longer

than the original Otter, allowing more cargo space and increasing the under-floor tankage capacity.

The Buffalo, developed from the piston-engined Caribou, is a larger, faster, turbine-powered addition to the range of STOL utility transports on which the company has been engaged for nearly 20 years. The Buffalo is ideally suited for military forces and other operators requiring an aircraft that can move loads up to 5½ tons to or from unprepared strips for distances of 460 n.m., 530 st.m., or 850 km.

Applications for de Havilland aircraft include the military — for STOL utility or tactical transports; feeder line and remote area charter or air taxi services; large-scale aerial agriculture organization; mineral and oil explorations, and construction firms requiring rapid, reliable air transport in regions where conventional airport facilities are not available.

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Rome, Italy

Oy Machinery AB  
P.O. Box 129  
Helsinki, Finland



short take-off and landing aircraft

The Turbo-Beaver has the same landing gear alternatives as the Beaver—it is a landplane, seaplane, skiplane, wheel-float amphibian, or wheel-skiplane.

## JARRY HYDRAULICS LTD./3600 Rachel Street East, Montreal 4, Quebec, Canada

Jarry Hydraulics Ltd. is one of Canada's leading manufacturers of hydraulic systems and components for aerospace. The creative engineering capability of the company is evidenced by flight-proven designs for landing gear, power flight controls, servo-valves and actuators which are standard equipment on almost all Canadian and many U.S. aircraft.

Jarry Hydraulics Ltd. recently completed construction of Canada's most specialized laboratory for the testing, development and qualification of landing gears, actuators and other hydraulic equipment used on aircraft. The testing equipment includes Canada's largest drop test rig for qualification testing of landing gears.

The equipment displayed by Jarry Hydraulics includes an aft landing gear complete with 360° electro-hydraulic power steering system, designed and manufactured for the Boeing-Vertol CH-47A Chinook helicopter; a wing spoiler actuator system designed and manufactured for the Lockheed C-141 Starlifter; wing tilt actuators for the Ling-Temco-Vought XC-142 and Canadair CL-84 V/STOL aircraft and the wing sweep actuator for the General Dynamics F-111 (TFX).

The C-141 wing spoiler actuator controls the spoiler surfaces which are located above and below the trailing edge of the aircraft wings to produce an aerodynamic braking action, particularly effective in reducing landing approach speed and shortening the taxi run. The manifold block contains 42 different components and valves and has more than 300 drilled cross-porting holes.

In the F-111 wing sweep actuator system, the pilot extends the wings outward from the fuselage for take-off and landing and sweeps the wings back near the fuselage for high-speed flight. Now fully tested and delivered, the actuator is designed to withstand a force of more than 500,000 pounds and can position the aircraft wings within .015" of the pilot's selected position at a rate of 200°/min.

The wing tilt actuators designed for the Canadair CL-84 and the Ling-Temco-Vought XC-142 V/STOL aircraft are ball-screw actuators which tilt the wing-engine-propeller assembly to the appropriate incidence angle for forward flight, short take-off and landing, vertical take-off and landing, and hovering.





## aircraft hydraulic systems and components

Fully tested, this wing tilt actuator — designed for the Ling-Temco-Vought XC-142 — can withstand more than 500,000 pounds of tension and can position the aircraft's wings within .015" of the pilot's selected position at a rate of 200°/min., using either or both of its two 40 gpm systems.

## CANADAIR LIMITED - Subsidiary of General Dynamics Corporation / P.O. Box 6087, Montreal, Quebec, Canada

Canadair Limited is now working on various programs in its 2,700,000-square-foot plant located on the outskirts of Montreal. The company is displaying examples from a number of these activities at the Paris Air Show.

The Canadair CL-84 Dynavert is a tilt-wing deflected-slipstream aircraft which has been developed for such military roles as ground attack, assault transport, helicopter escort or destroyer, casualty evacuation, reconnaissance and aerial command post. It has both vertical and short take-off and landing (V/STOL) capability, and a maximum speed of 350 mph (563 km/hr).

In the STOL mode, in which the Dynavert clears 50 ft. (15.2 m) after a run of only 500 feet (152.4 m), a payload of 5,600 lb. (2,540 kg) can be carried, compared with 3,100 lb. (1,406 kg) VTOL.

The Canadair CL-89 short-range reconnaissance drone system is being developed for the Canadian and British armies, with firing range facilities and technical support provided by the U.S. Army.

The CL-89 is a self-contained and mobile system which could be employed to perform, by day or night, the functions of target acquisition, damage assessment and surveillance, in the face of

strong enemy air defences. It has highly developed photographic sensor equipment; an accurate navigation system; a short response time to furnish up-to-date information; and a high probability of survival.

The Canadair CL-41G is a multiple-role aircraft based on the CL-41A Tutor all-through jet trainer. It has been developed for weapons training, border patrol, counter-insurgency, reconnaissance and other tactical missions.

The 41G carries up to 3,500 lb. (1,588 kg) of standard U.S. ordnance stores. These include general-purpose and napalm bombs; machine-gun pods; air-to-surface missiles; clusters of folding-fin aircraft rockets.

The Canadair CL-44 long-range turboprop transport is in scheduled airline service as a freighter and a passenger airplane. As an all-cargo aircraft it is in operation with Flying Tigers, Seaboard World, Slick and BOAC. Loftleidir/Icelandic Airlines use the CL-44 on their North Atlantic passenger route and have now ordered a "stretched" CL-44J which will accommodate 189 passengers.

The Canadair Dynatrac is a highly mobile, fully tracked utility vehicle that is designed for

military operations over all kinds of terrain even under the most adverse weather conditions. Its articulated steering method vastly reduces the chances of bogging down.

Empty or fully loaded, the Dynatrac retains its mobility in mud, soft marshes, water, jungle swamps, muskeg, forests, rocky and stumpy terrain, unimproved roads, tundra, and deep snow. It operates at high altitudes and under conditions of driving rain, snow, sand or dust at temperatures ranging from  $-65^{\circ}$  to  $115^{\circ}$  F ( $-53.9^{\circ}$  to  $46.1^{\circ}$  C).

In its standard, two-unit configuration, the Dynatrac can carry a payload of 2,000 lb. (907 kg) or 9 men and their equipment, in addition to the driver. It also can be operated in a fully articulated three-unit configuration, or as a single unit.

Canadair is also displaying a model of a water bomber — an entirely new aircraft of amphibious design being developed specifically for water bombing forest fires — and a portable control tower which can be carried in small aircraft. The tower is easily broken down and assembled, and has VHC, VHF, LF, radio beacon, radar and meteorological equipment.





aircraft design,  
development and manufacture

The new Canadair CL-84 Dynavert takes off vertically with its wings tilted up. The wings are then tilted down to the horizontal for forward flight at speeds up to 350 mph (563 km/hr). If a small airstrip is available, double the normal payload may be carried by tilting the wings half-way to the vertical so that extra lift is created during a short ground run.

## AVIATION ELECTRIC LIMITED / 200 Laurentian Boulevard, Montreal 9, Quebec, Canada

Aviation Electric Limited manufactures flight and engine instruments and accessories, aerospace vehicle instruments and systems, surface navigation systems, special devices and industrial control systems. It is currently carrying out extensive research and development programs in the fields of high "G" technology and fluid-state amplifiers.

The company is displaying its land navigation systems, multiple charge canister for anti-submarine warfare, orbit injection control system adapted to the Martlet vehicle used in the High Altitude Research Project (HARP) in Barbados, and fluid amplifiers.

Designed and developed in co-operation with the Canadian Army, the company's land navigation set permits accurate navigation with pictorial displays for vehicles operating under unfavourable visibility conditions or in country devoid of landmarks.

It can be used by aircraft on the ground and airport service vehicles for traffic to and from terminal areas under nil visibility conditions. It is simple to operate, of rugged construction and adaptable to alternative map scales.

The multiple charge canister was developed for

the RCAF as a detection device for anti-submarine warfare. Following launching from an aircraft and contact with the water, a series of canisters containing explosive charges is released at predetermined time intervals, detonating at pre-selected depths.

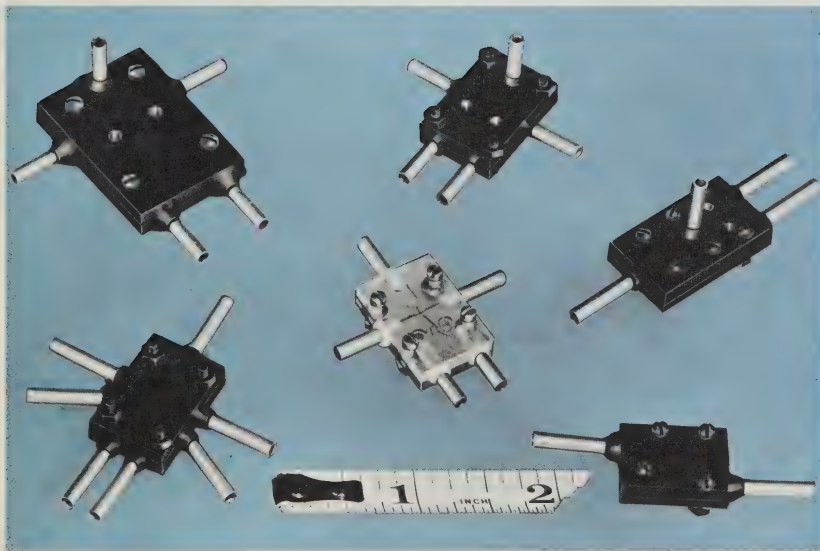
The company is also displaying the stream release valve used in the Martlet missiles. This device releases streams of tri-methyl aluminium (TMA) for high altitude wind shear research. The orbit injection control system to be used on the Martlett IV missile consists of infra-red telescopes, sun sensors, solid-state electronic modules and reaction control valves which operate to process the spinning missile so that it is pointed correctly in its successive stages of firing. The system is subjected to gun launch accelerations of approximately 10,000 g.

Aviation Electric is actively engaged in a fluid amplifier research program representing the first Canadian effort in a very new and rapidly expanding technology. The fluid amplifier on display is a static device in which low-energy fluid controls higher energy fluid, and may be considered as the fluid equivalent of the electronic vacuum tube.

### **Represented by:**

Bendix International  
49, avenue George V  
Paris 8e, France

M. Niebel  
Heidelberg-Kirchheim  
Oppelnerstrasse 63  
Heidelberg, West Germany



surface navigation systems,  
aerospace components  
and fluid amplifiers

Aviation Electric's fluid amplifier in which low-energy fluid controls higher energy fluid in a no-moving-part device may be considered as the fluid equivalent of the electronic vacuum tube. It combines the features of low cost and long life with exceptional environmental tolerance.

## COMPUTING DEVICES OF CANADA LIMITED / P.O. Box 508, Ottawa 4, Ontario, Canada

Established in 1948, Computing Devices of Canada Limited has gained international recognition in the fields of airborne navigation systems and displays, photo-optical systems, advanced electronics instrumentation, systems design and management, and aerospace research.

The company's display includes PHI navigation systems; tactical, integrated and head-up display systems; circuit analyzer, photo-reconnaissance systems, moving map display and high "G" telemetry packages.

The position and homing indicator (PHI) forms an essential part of the navigation systems of first-line aircraft of eight NATO nations and Australia. It accepts inputs from inertial, Doppler or air data systems and operates independently of ground outputs. The PHI-10B — a recent refinement — is designed for fixed-wing, rotary, and VTOL aircraft with speeds ranging from negative velocities to supersonic. In the ASW helicopter role, a range of tactical, cross-pointer, pattern and head-up displays is available to meet the diversified requirements of operating from a moving base over water in all kinds of weather.

The PHI-tel 100 — in an entirely different field — can be programmed to generate any message

format. Routing instructions are performed through a clearly defined push-button sequence. A major breakthrough in the communications area, this system provides a link between the unskilled manual operator and a fully automatic message switching system.

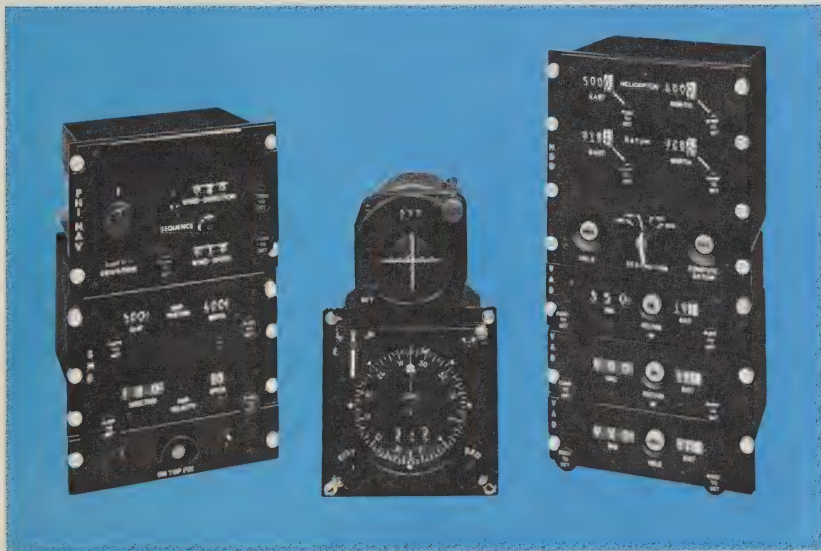
The tactical moving map display (TopoMap) is a new concept in low-level, high-speed navigation. It provides a track-oriented full-colour map which moves simultaneously with the aircraft. With a map scale of 1:500,000, an area of approximately 1,800 x 1,800 nautical miles is covered in a single roll of 35 mm film. The system accepts inputs from self-contained navigation sensors — Doppler radar and inertial platform.

One of Computing Devices' latest developments is the IDS-5 improved horizontal situation indicator. This integrated display system shows range and bearing to destination, lateral deviation from selected track and pictorial horizontal situation in relation to a selected VOR, TACAN, VAR or ILS track. With this indicator the pilot has a superior display of his over-water position combined with situation command information and can fly predetermined tracks to sonobuoys with automatic drift compensation.

### Represented by:

Computing Devices Company Ltd.  
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126/128 Cromwell Road  
London, S.W.7, England

Bendix International Operations  
605 Third Avenue  
New York, N.Y. 10016, U.S.A.



electronic and electromechanical  
aerospace systems

The PHI-10B navigation and tactical system has been designed to meet the specific needs of the ASW helicopter pilot. It combines all the features of an integrated airborne navigation system with easily interpreted displays. The system can be adapted to a variety of helicopters, fixed-wing and VTOL aircraft, because of its modular design.



## OKANAGAN HELICOPTERS LIMITED / Vancouver, British Columbia, Canada

Okanagan Helicopters Limited is one of the oldest and largest helicopter operating companies in the world. Formed in 1947 it operates a fleet of more than 60 rotary wing aircraft and provides services on an international basis.

In 1961 Okanagan Helicopters retained Ingledew Kidd & Associates Limited also of Vancouver to provide for the first time a package unit of flying skill and engineering practice. As the result of this association a number of important advances were made in the utilization of helicopters for construction purposes and as an outgrowth of this work a series of specialized items of helicopter hardware were designed, one of which is the aerial line stringer. This stringer, which has been successfully used on a number of projects in Canada permits the stringing of wires, cables or ropes from the air at speeds of up to 50 miles per hour.

Within recent months a new company has been formed, Ariel Engineering Limited with headquarters in Vancouver and associated offices throughout North and South America, Europe and Asia. This company will provide specialized flying, design and engineering services to the survey, exploration and construction industries.



helicopter engineering service

A Sikorsky S-58 heavy helicopter is in the process of setting a guyed "V" aluminum transmission tower.

## INFORMATION

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*Officials of the Canadian Department of Trade and Commerce and representatives of the Canadian companies participating in the 26th International Air and Space Show will be pleased to answer inquiries at the Show. Information is also available from the following Canadian trade offices.*

### FRANCE

Ministre-conseiller  
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### AUSTRIA

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## **BELGIUM**

Conseiller commercial  
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## **BRITAIN**

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